

REMARKS

This Amendment is filed in response to the Office Action dated May 15, 2006. In the Office Action, claims 2-4, 6-9 and 12-14 were rejected under 35 U.S.C. §103(a) in view of EP072405 ("Akashi") and U.S. Patent No. 5,522,127 ("Ozaki"). In response, claim 12 has been cancelled without prejudice or disclaimer. Claims 2-4, 6, 8 and 13-14 have also been amended. Claims 15-16 have been newly added. No new matter has been added by way of amendment or the new claims. A Petition for a One-Month Extension of Time to Respond to the Office Action is submitted herewith. The Commissioner is hereby authorized to charge deposit account 02-1818 for the One-month extension and any other fees which are due and owing in connection with this response. Applicants believe that the obviousness rejection has been overcome in view of the amendments and at least for the reasons discussed below.

Of the pending claims, new claim 15 is the sole independent claim. Claim 15 recites a gel electrolyte secondary cell including a positive electrode; a negative electrode; and a gel electrolyte. The negative electrode includes a current collector and a powder mixture including a graphitized carbonaceous material obtained from a plurality of meso-carbon micro-beads and a binder, wherein the powder mixture is coated on the current collector at a thickness ranging from 10 μm to 200 μm . The gel electrolyte includes an electrolyte salt, a non-aqueous solvent and a high-molecular weight material having a number average molecular weight ranging from 5000 to 500000 wherein the non-aqueous solvent at least includes propylene carbonate and ethylene carbonate. As amended, claim 15 further recites that the propylene carbonate ranges from 10 mol% to 35 mol%. Claim 16 has been newly added to further specify a specific surface area of the graphitized carbonaceous material, as discussed in further detail below.

Applicants respectfully submit that Akashi and Ozaki fail to disclose all of the elements of newly added claim 15, even assuming that they are properly combinable. For example, Akashi does not teach or suggest a negative electrode comprising a current collector and a powder mixture including graphitized carbonized material obtained from a plurality of meso-carbon micro-beads. On the contrary, Akashi describes examples where the negative electrode 2 is prepared by cutting a metallic lithium plate having a thickness of 2 mm into a sheet piece (see, Akashi, pg. 9, lines 39-40), and where the negative electrode is a disc-like platinum electrode

(see, Akashi, pg. 4, lines 47-48). Clearly, the focus of the negative electrode material in Akashi is related to metals and not to a carbon based material.

Moreover, even to the extent that Akashi generally provides that the negative electrode activating ingredient may include a carbonaceous material, the experiments in Akashi do not provide any data with regard to preferred mixing ratios of the respective components of the gel electrolyte in the context of a negative electrode including a carbon material (much less a powder mixture including graphitized carbonized material obtained from a plurality of meso-carbon micro-beads, as recited in new claim 15). For example, the section of Akashi that details an evaluation of gel electrolyte as an electrolyte material for cells, uses the following components for the gel solution: (a) 15 mole % ANM; (b) 57 mole % EC; and (c) 28 mole % PC. However, these mole ratios indicate, at best, what ratios may be desirable for a cell having a negative electrode made out of metallic lithium. (See, Akashi, pg. 9, lines 39-40 and 45-51). Accordingly, the experimental results in Akashi that indicate preferred ranges for the components of the gel electrolyte (i.e., acrylonitrile monomer ("ANM"), ethylene carbonate ("EC"), and propylene carbonate ("PC")) cannot and should not be assumed to apply to a negative electrode composed of a plurality of meso-carbon micro-beads. For at least these reasons, Akashi does not teach or suggest what, if any combination of gel solution components would be desirable for a cell having a negative electrode including graphitized carbonized material, let alone obtained from a plurality of meso-carbon micro-beads as recited in new claim 15.

Further, Applicants respectfully submit that Ozaki fails to cure the deficiencies of Akashi, even assuming that they are properly combinable. For example, Ozaki fails to disclose a negative electrode having a powder mixture including a graphitized carbonaceous material obtained from a plurality of meso-carbon micro-beads and a binder, and a gel electrolyte comprising an electrolyte salt, a non-aqueous solvent and a high-molecular weight material wherein the non-aqueous solvent at least includes propylene carbonate in an amount ranging from 10 mol % to 35 mol% and ethylene carbonate, as recited in amended claim 15. There is no teaching or suggestion in Ozaki that the described meso-carbon micro-beads could be used in an electrolytic cell having the gel solution as taught by Akashi (e.g., 15 mol % ANM, 57 mol % EC, and 28 mol% PC). In fact, Ozaki explicitly teaches the opposite. For example, Ozaki states that

“as for the organic solvent of the organic electrolyte for the non-aqueous electrolyte, propylene carbonate (PC) is not employed, because it decomposes to generate a gas [at] during charging.” (See, Ozaki, col. 7, lines 5-9, emphasis added).

This statement in Ozaki lends credence to Applicants’ argument above that Akashi, although generally stating that the negative electrode could be any type of carbonaceous material, does not specifically contemplate using meso-carbon micro-beads as negative electrode material, much less the meso-carbon micro-beads recited in amended independent claim 15, where the non-aqueous solvent at least includes propylene carbonate in an amount ranging from 10 mol % to 35 mol%. Indeed, Ozaki is evidence that a person of ordinary skill in the art, at the time the invention was made, would not have thought to combine meso-carbon micro-beads as a negative electrode material in an electrolytic cell having a significant concentration of PC. Indeed, at page 5, lines 3-10 of the present application, this fact is noted:

However, if propylene carbonate is used as a non-aqueous solvent of the gel electrolyte, the following inconvenience is encountered ... if, in the non-aqueous liquid electrolyte secondary cell, employing propylene carbonate as a main solvent, a graphite type carbonaceous material is used as a negative electrode, propylene carbonate is decomposed in a known manner on the negative electrode with gas evolution (see, for example, Z.X. Mcmillan, J.J. Murray, J. Electrochem. Soc., 140,922 to 927 (1993)).

At the time the present invention was made, a combination of meso-carbon micro-beads as a negative electrode material in an electrolytic cell having a concentration of PC was, quite simply, rejected by those of skill in the art. Therefore, as mentioned above, the experimental data relating to mole percentages of the gel solution in Akashi can not properly be relied on when attempting to combine the teachings of the meso-carbon micro-beads in the negative electrode material in Ozaki. In other words, based on the knowledge at the time of one skilled in the art, these mole percentages would be assumed to not apply if used in the context of a carbon based negative electrode. Accordingly, Akashi and Ozaki fail to disclose each of the elements of amended claim 15, even assuming that they are properly combinable.

Indeed, Applicants have demonstrated improved results with a propylene carbonate content ranging from 10-35 mol % based on the non-aqueous solvent), even in the presence of

meso-carbon micro-beads as recited in amended claim 15. (See, Specification, pg. 13, lines 14-17). Therefore, for at least the reasons above, Applicants respectfully submit that amended claim 15 is patentably distinguished over the combination of Akashi and Ozaki.

Accordingly, Applicants respectfully request that the obviousness rejection in view of Akashi and Ozaki be withdrawn.

In addition, Applicants respectfully submit that newly added dependent claim 16 is patentable over the combination of Akashi and Ozaki. Claim 16, which depends from new claim 15, recites wherein the graphitized carbonaceous material has a specific surface area that ranges from $0.1 \text{ m}^2/\text{g}$ to $1.2 \text{ m}^2/\text{g}$. In contrast, Ozaki discloses a preferred specific surface area range of 2.5 to $5.0 \text{ m}^2/\text{g}$ for the mesophase graphite particles. Importantly, Ozaki states that “if the specific surface area is less than $1.0 \text{ m}^2/\text{g}$, the high-rate discharge characteristics and rapid-charging characteristics are inferior.” (See, Ozaki, col. 6, lines 52-54). Moreover, Akashi fails to provide any teaching regarding a specific surface area associated with a carbon-based material, let alone the graphitized carbonaceous material as claimed. However, Applicants have demonstrated improved results when the surface area of the meso-carbon micro-beads have a lower specific surface area.

For example, Table 1 illustrates that an improved charging capacity can be achieved with a meso-carbon micro-bead having a specific surface area of $1.2 \text{ m}^2/\text{g}$. (See, Specification, pg. 20). Example 1 utilizes a meso-carbon micro-bead (manufactured by OSAKA GAS KK under the trade name of MCMB6-28) which was measured to have a specific surface area of $3.6 \text{ m}^2/\text{g}$. (See, Specification, pg. 16, lines 11-16). The resulting charging capacity was 290 mAh/g , as shown in Table 1. In Example 2, an evaluation cell was prepared in the same way as in Example 1 except using powders of the carbonaceous material of the operating electrode manufactured by OSAKA GAS KK under the trade name of MCMB25-28. The measured specific area of these powders was $1.2 \text{ m}^2/\text{g}$, according the BET adsorption method. As mentioned above and as shown in Table 1, the Example 2 using the meso-carbon micro-beads having a smaller specific surface area of $1.2 \text{ m}^2/\text{g}$ was shown to have an improved charging capacity of 327 mAh/g . Applicants also note that Ozaki teaches that inferior performance would be obtained with a particle of this size. (See, Ozaki, col. 6, lines 52-54). Also, Applicants point out that the upper end of the range of surface areas in new claim 16 (i.e., 0.1 to $1.2 \text{ m}^2/\text{g}$) is over twice as small as

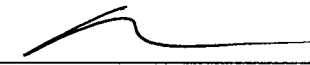
the lower end of the preferred range in Ozaki (i.e., 2.5 to 5.0 m²/g). Accordingly, Ozaki effectively teaches away from using a meso-carbon micro-bead as recited in dependent claim 16, and, again Akashi is deficient with respect to this feature as well as discussed above.

Accordingly, Applicants respectfully submit that newly added claim 16 is allowable for this reason in addition to the reasons listed above with respect to the 35 U.S.C. §103(a) rejection.

For the foregoing reasons, Applicants respectfully submit that the present application is in condition for allowance and earnestly solicit reconsideration of same.

Respectfully submitted,

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